International Snowy Plover Survey Protocol
Discrete Site Survey Methodologies
Final - April 27, 2007

BACKGROUND AND INTRODUCTION

The primary purpose of this survey is to obtain an estimate of the number of breeding Snowy Plovers at current, historic, and potential breeding sites in the interior and Gulf Coast of the U.S. and coastal Mexico. These surveys will provide information on the local, regional, and North American distribution and abundance of Snowy Plovers. Surveys will be conducted during non-migratory periods when birds are breeding in the region, over a narrow time frame to minimize the chance of recounting birds moving between sites.

The following methodologies are intended for use at discrete sites. All sites were previously identified as areas where Snowy Plovers are known to breed or where there is some potential for breeding Snowy Plovers due to suitable habitat. Sites are considered "discrete" if all suitable nesting and foraging habitat associated with the site can be surveyed in its entirety in one day. Suitable habitat inland consists of shores of [predominantly alkali] lakes, reservoirs, ponds, braided river channels, and playas (mostly at seeps and along streams). Although at inland habitats most feeding is in shallow (1-2 cm) water or on wet mud or sand, on playas some foraging also occurs on dry flats (Page et. al, 1995). Preferred roosting (or resting) areas consist of "footprints, vehicle tracks…" or behind small debris (Page et. al., 1995). Examples would be small basins, a section of beach with suitable habitat, a river segment, or small flats. Larger sites may also be considered "discrete" if multiple individuals can survey all potential habitats at the site in one day and resources are sufficient to ensure participation by enough surveyors to accomplish this goal.

Since all plovers are not detected on a single survey, a single survey does not represent a total count, but gives an index of population size. This protocol aims to standardize survey methodology to minimize geographic disparity in the quality of the count. We will also measure detectability using a "repeated measures" approach. This will involve conducting two replicate or repeat surveys at a subset of selected sites.

Previous state and local efforts have included surveys by foot, ATV, airboat, and motorboat. This inventory will be conducted primarily by foot, but under certain circumstances other methods will be employed. The best methodology for each site has been assigned based on input from local area experts. Each area will be surveyed on foot unless indicated by your regional coordinator. Since detectability will likely vary based on method used, it is very important that a change in methodology at a site be discussed with the regional coordinator and documented with all data that is submitted. Below we discuss the timing and general methodology for foot surveys. Special guidelines for ATV, airboat, and motorboat surveys are included in appendices, in addition to a datasheet, field checklist, and a short section on reading color bands.

TIMING AND SURVEY METHODOLOGY

The breeding range was divided into several discrete geographic regions. Survey windows are approximately 4 – 6 weeks long. Dates fall between May and June and were chosen by local

area experts to coincide with the period of peak Snowy Plover nesting (Table 1). Every attempt should be made to survey all sites in as short a time as possible, particularly sites in close proximity of one another.

Survey coordinators for each designated survey area will provide survey protocol and maps to trained surveyors (see *Qualifications and training*) online at http://www.fws.gov/pacific/migratorybirds/snowyplover/. The most appropriate survey conditions and number of surveyors should be decided by a local biologist, familiar with the site in general and conditions at the time of the survey. To maximize detection, surveys should be conducted during good weather and high visibility. Glare and heat waves can be a problem on sunny days, so visibility is usually best in the early morning or evening hours. Hence, every effort should be made to start surveys within one hour of sunrise. This will be particularly important at larger sites which take many hours to complete. Smaller sites can be covered in the evening hours (after 5 pm) if necessary, but only if there are enough daylight hours remaining to complete the survey. Rainy, foggy, or excessively windy conditions (15 mph or greater) are not ideal for surveying however, a slight drizzle or strong breeze (5-10 mph) is acceptable. In some regions a strong wind may be almost unavoidable; if possible, try to conduct surveys on calmer days or at times of the day when the wind is low (<15 mph).

Table 1. Survey timing for specific states and geographic regions.

State/Region	Date
MX	April 25 - June 30
NM, TX, and AZ	May 1 – May 31
CA, NV	May 1 – June 30
UT	May 7 – June 7
OK	May 15 – June 7
CO	May 15-June 15
CO (San Luis Valley/South Park area only)	May 29 - June 29
OR, NE, KS	June 1- June 30

The basic approach for surveying Snowy Plovers is to conduct a thorough search while walking through all potential nesting and foraging habitat at each site. Surveying by foot is likely to have the highest detection rates, so most sites will be covered by foot. ATV's, airboats, or motorboats may be used to gain access to a site (or suitable portion of a site), but after obtaining access, survey all suitable habitat by foot. Surveys should only be conducted by ATV, airboat, or motorboat if surveying by foot is not practical. **If a site or portion of a site can not be surveyed by foot, contact your regional coordinator prior to conducting the survey.** Following are the general guidelines for how to survey a site:

1. All potential breeding and foraging habitat should be covered in the same manner - in one pass. There should be one very careful pass to tally the number of birds on each segment of suitable habitat.

2. The number of surveyors covering a site (or stretch of shoreline within a larger site)

should correspond with the width of the habitat and surveyors should be spaced 100 m (328 ft.) apart. One surveyor with binoculars and a spotting scope is sufficient to cover habitat less than or equal to 200 m (656 ft.) wide. Every 100-meter (328 ft.) increase in habitat width will require one additional surveyor. So two surveyors would be required if habitat is 300 m (984 ft.) wide, three surveyors are needed if the habitat is 400 m (1,312 ft.) wide, etc. (see Figure 1).

3. Multiple observers surveying a site together should cover the site by walking in unison along the entire length of suitable nesting and foraging habitat on survey maps provided. Surveyors should simultaneously walk as many parallel transects as is necessary to cover all habitat. These transects should run parallel to any shoreline.

4. To assure that very large sites are covered in one day use a team of surveyors (at wide sites) or multi-observer or multi-team approach. For example, at a lake that is 10 miles in circumference, a team of three might cover a 5 mile stretch on the side with habitat, about 400 m (1,312 ft.) wide, while a single surveyor simultaneously surveys the narrow shoreline on the opposite side of the lake (Figure 1).

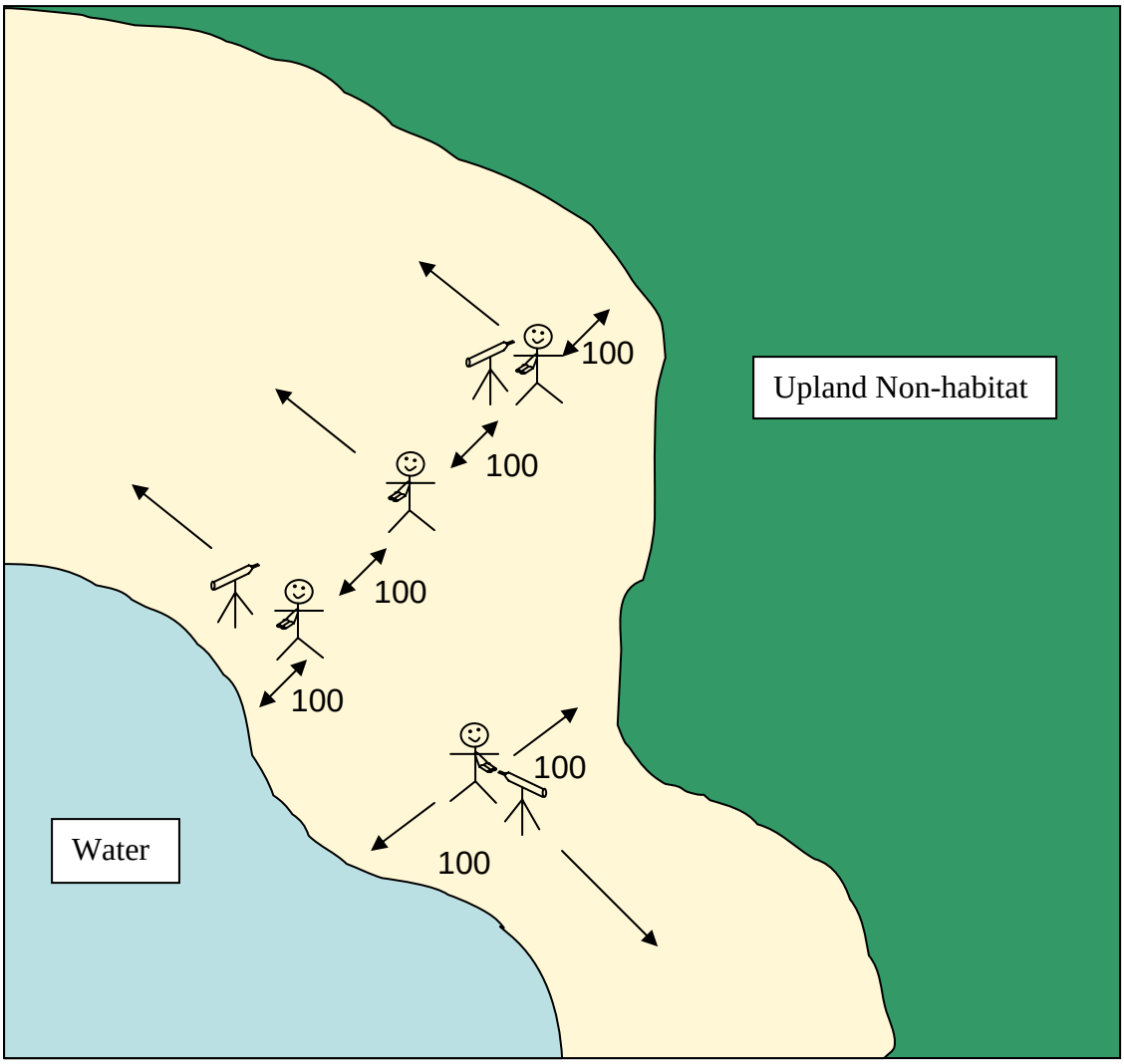

Figure 1. Example of how a site might be surveyed. A team of three surveyors covers the wide habitat to the northeast, while a single observer simultaneously surveys the narrow portion to the southeast.

5. Site maps and/or aerial photos may help determine the approximate number of surveyors needed, but the final number should be decided in the field, based on the amount of suitable habitat at the time of the survey. These maps can be downloaded directly at http://www.fws.gov/filedownloads/ftp%5Fgis/R1/NWRS/SNPL%5FFieldMaps/. Double click the state of interest and select your map by the site name. To open and print the maps double click on the file and it will open Adobe Acrobat Reader, which will allow you to print a hard copy. Water level can be quite dynamic at many sites so your site maps may not reflect the current habitat conditions. Take into account these inconsistencies when delineating your survey area and suitable habitat not surveyed on the map (*see Data Collection and Reporting Requirements*). If possible, visit the site a week or two before the scheduled survey to estimate the number of surveyors needed.

6. Every surveyor should have a good pair of binoculars (8-10x and aperture of at least 40 mm.). If the site is being covered by one observer, a spotting scope and GPS unit are also required. When surveying in a team, every other observer should have a spotting scope and GPS unit (i.e., 1 scope and GPS should be used by a team of 2 observers, 2 scopes and 2 GPS units for a team of 3 or 4, etc).

7. To more accurately delineate the area surveyed, we suggest using a GPS unit to track the survey path closest to the shoreline. This may be particularly useful if you are not very familiar with the site, the water level at the site varies greatly, and/or your field conditions do not look like what is represented on your aerial-photo map. If you are surveying the site as a team (or multiple teams), we suggest the observer closest to the shoreline and closest to upland vegetation (furthest from the shoreline) both track their routes with GPS units.

8. When surveying in a team, every observer must have a working walkie-talkie or hand-held radio. Clear communication is essential to assure that multiple observers do not count the same birds twice. Also pack extra batteries.

9. If a small (< 500m or 1,640 ft. long) section of a site is wider than the rest, the surveyor furthest from the shore should walk in a zig-zag pattern through the wider portion of the route, to ensure complete coverage. Other surveyors in the team should slow down their pace so that surveying can continue in unison. If there is an extremely wide portion of shoreline (> 200 m (656 ft.) wider than the rest of the shore, or if this wide section is longer than 500 m (1,640 ft.), use additional surveyors to cover the area.

10. If visibility or communication is impaired for any reason, surveyors should be spaced more closely. Communication will be reduced if hand held radios or walkie-talkie's are not available or working properly. Visibility may be affected by the quality of optics, habitat conditions, and weather conditions. If you suspect that any factor is reducing visibility or communication ability, surveyor distance should also be reduced to no more than 50 m (328 ft.) between observers. Reduce observer distance if there are not enough spotting scopes or if a breeze is causing scopes to shake. Reduce observer distance if there is any fog or if heat waves are rising from the ground and obscuring view. Reduce observer distance if the area is heaved, has hummocks, patchy vegetation, hollows, or depressions (i.e. natural, tire tracks, or footprints; plovers may roost in these depressions), cow pies, small debris, or other topographical irregularities.

11. Surveyors should alternate between walking and scanning for Snowy Plovers with binoculars and a spotting scope. Surveyors should continuously scan with their naked eyes the area ahead and to either side. Every 100 m (656 ft.) or less, surveyors should stop and scan at least 100 m (656 ft.) in all directions (360˚) with binoculars (distance may be shorter based on site-specific conditions), followed by a spotting scope. If the surveyor does not have a spotting scope they should stop and scan with binoculars

every 50 m (328 ft.). This way habitat is searched at least twice and from different angles increasing the chances of detecting birds. If a bird is sighted far ahead, look for distinguishing landmarks that will help you relocate the bird once you are closer to it. Some birds may freeze and/or lay flat in a shallow depression (i.e., a footprint or vehicle tracks) as they are approached, making them difficult to see.

12. Take **care not to double-count birds by keeping track of their movements whenever possible.** When surveying in teams, surveyors should point out birds that have been counted but are moving through another observer survey area.

13. If roosting plovers are sighted they should be approached prior to counting and flocks should be counted by two observers whenever possible. Roosting plovers may be particularly difficult to see. Birds may roost in loose aggregations and some individuals may be roosting in depressions, which can make them difficult or impossible to detect from a distance. If a roosting bird is encountered, the closest observer should approach the bird, stop about 15 m (49 ft.) from the bird, and scan the area. If there are many birds roosting in the area, two observers should approach and both observers should count the birds observed. Record the highest count.

14. Large flocks encountered on the shoreline should also be counted by at least two observers whenever possible. If you encounter a flock of more than 20 birds, or a smaller flock that is difficult to count for any reason (i.e., they are moving), ask a second observer to help count the birds. Record the highest count.

15. **Surveyors should watch the ground carefully for nests and chicks.** The pace of the survey needs to be slow enough to allow surveyors to watch the ground and make frequent short stops to look ahead for plovers, chicks, and nests. Surveyors risk trampling chicks which are much harder to detect than nests. If surveyors detect males or females performing distraction displays, they should recognize they are probably very close to chicks or eggs and should move away with extreme caution, looking very carefully where each foot is placed. Head bobbing may also be a sign that there is a nest nearby (for more information about breeding behavior see the *Birds of North America* Snowy Plover Species Account, Page et al. 1995).

DATA COLLECTION

Data collection must be standardized for all surveys and for all sites. The following methodology should be used:

1. Field data should be collected on a datasheet (see Appendix 1 and 8). It is highly recommended that all data be transcribed directly onto the standardized data collection sheets. Additional notes may be kept within personal notebooks. Xerox copies of data sheets should be kept in your files, deliver original official data sheets and map(s) to the survey coordinator.

2. If you are using a multi-team approach to cover your site (or have multiple observers

covering different stretches of shoreline), each team should have their own map and data sheet(s). Each team should be identified on their data sheet(s) and map with a letter (i.e., Team A, B, C, etc).

3. You must also use a new data sheet when an individual or team takes a break for longer than 10 minutes. For example, at a site where there is suitable habitat only on the north and south ends, a team of two starts off surveying habitat on the south end. They then walk back to their vehicle, eat a sandwich, and drive to the northern portion of the site. They must use a new data sheet when surveying this northern section.

4. Prior to conducting the survey, examine the map/aerial photo provided to see if the habitat in the field is the same as it appears on the map. Is the shoreline in the same place as it is on your map? Are some areas flooded that appear dry on the map? Has vegetation encroached on an area which on your map appears unvegetated? Keep these questions in mind while you survey.

5. At the beginning of the survey the recorder should fill out preliminary portions of the data sheet: date, survey location, number of observers (in your team), contact information, start time, and weather.

6. Record the survey technique used (foot, ATV, airboat, or motorboat). If you used a combination of methods, describe this in the comments section, record the time spent using each method, and mark locations of observers/teams and survey techniques on the map (if multiple methods are used).

7. While it is best for one member of the team to act as official recorder, all members of the team must have a pencil and data sheet or field notebook so that they can record observations for their transect (time of observation, GPS location, age, etc.) in the event that they can not communicate effectively with the recorder (i.e., broken radio, or lots of static).

8. If an area is being surveyed by multiple observers simultaneously, they should communicate among themselves using a walkie-talkie or hand-held radio whenever a bird is seen.

9. Approximate GPS location of the bird(s) should be recorded (using decimal degrees, WGS84) in addition to any nests found. Also mark the approximate location of all individuals and/or flocks on your map with the number corresponding to the line on which they are entered on your data sheet. Mark any nests with a star or asterisk (*; see Appendix 8).

10. The objective of this survey effort is to count adult plovers. Report the number of adults by sex (M/F) if known, or simply record the number as unknown (U). The number of chicks or juveniles can be noted in the associated comments section for the "Map #" associated with the adults reported.

11. Record the behavior of individual birds or aggregations of birds in one of the following four categories: breeding behavior (B), foraging (F), roosting (R), flyover (FO) or unknown (U). Breeding behavior can include copulation, scraping, territory defense, an adult incubating or near a nest, a broken wing display or other distraction displays (for more information about breeding behavior see the *Birds of North America* Snowy Plover Species Account, Page et al. 1995).

12. If a bird is flying over you while you are surveying, do not record the bird unless it is flying towards the area you have just surveyed. We want to minimize double-counting, so do not record a flying bird if there is any risk that you or another observer might count this bird a second time. If the bird is flying toward previously surveyed area, enter "FO" as behavior.

13. Although you should check each bird for color bands, we do not want to detract from the survey effort by spending time reading band combinations. If a color-banded bird is sighted, someone should come back to read the band combination after the survey is completed. Ideally, this person should be experienced in reading color bands and familiar with the color combinations in your area. However, for more information on reading color bands see Appendix 7 (Color Band Observations).

14. Record end time upon leaving the site, or when leaving the segment of suitable habitat that you are surveying. Person-hours should be calculated by multiplying the number of surveyors in your team by the time spent surveying (i.e., 3 observers x 1.5 hrs = 4.5 person-hours).

15. Prior to leaving the site, **indicate the area that was surveyed by drawing a circle (or other closed polygon or free-form shape) around the area surveyed** (see Appendix 8). **This information is critical to the interpretation an analysis of survey results and will inform any future survey efforts.** If possible, use different colored pens to indicate area surveyed, habitat not surveyed, and non-habitat.

16. If the shoreline has changed or if there a patch of unsuitable habitat **within** the polygon you drew to designate your survey area (i.e. willow stand), **mark this unsuitable area with cross hatching** (see Appendix 8).

17. If you were not able to survey all of the suitable habitat at the site, **clearly mark any habitat not surveyed by encircling the area and drawing parallel hatches** (see Appendix 8). Write an explanation of why the habitat was not surveyed in the comments section of the data sheet or an attached sheet (i.e., habitat inaccessible due to mud, private property which we did not get permission to survey, etc.).

18. Check data sheets and maps shortly after the survey is completed (within a day), to ensure that all data was accurately recorded.

19. Download waypoints and survey route after returning from the field. If possible,

compare GPS route(s) to your marked field maps by viewing the survey route(s) on a digitally referenced aerial photo (in ArcMap or similar program).

REPLICATE SURVEYS

Repeat or replicate surveys will be conducted at a selected subset of sites to assess detectability. To assure minimal movements of birds, repeat surveys should be conducted as close to the initial survey as possible to limit the possibility of birds leaving or joining the site. During ideal weather or for small sites, it may be possible to conduct initial and follow up surveys in the same day (e.g. initial survey in the AM; repeat survey in the PM). At larger sites, every effort should be made to conduct initial and replicate surveys on consecutive days. At the very greatest, replicate surveys must be conducted within 5 days of the initial survey using the following guidelines:

1. **Initial and replicate surveys should be conducted using the same survey technique and number of people.** The same amount of habitat should be surveyed using the same number of people and same methodologies. For example, if a stretch of shoreline is initially surveyed by four people on foot, the same stretch of shoreline should be surveyed a second time by four people walking the site. Make note of how much time was spent surveying the site initially and spend approximately the same amount of time conducting the replicate survey.

2. Ideally, repeat surveys should be conducted on consecutive days by different observers.

3. If surveying a site twice during the same day, different observers are mandatory. The same surveyor should not survey the same stretch of shoreline in the same day.

4. If the same surveyor or team of surveyors will be conducting the replicate survey, conduct the two surveys on different days (ideally consecutive days).

5. When surveying as a team, team members should switch their positions. The person surveying at the shoreline during the initial survey should take an inland transect on the replicate, and vice versa.

6. If a multi-team effort is employed at the site, teams should switch and cover different stretches of shoreline than they covered on the initial survey.

SURVEYOR EDUCATION AND PREPAREDNESS

Equipment: See Appendix 6 for a field checklist of required and recommended equipment and materials.

Qualifications: Required qualifications for Snowy Plover surveyors are:

- Ability to walk several miles in dry sand, alkali mudflats or other Snowy Plover habitat.
- Good vision.
- Capable and comfortable using binoculars and spotting scopes to watch birds.

- Some familiarity with identification of Snowy Plovers and other similar species that could potentially be in the survey area (i.e., Semipalmated Plovers, Piping Plovers, Wilson's Plovers, Killdeer).

  Training: Experienced observers should receive a short training or at least a field check, to make sure that they can accurately estimate 50 m (328 ft.) and 100 m (656 ft.) distances (within 5 m (16 ft.)). If naïve or inexperienced observers will be conducting surveys, they should receive some training in Snowy Plover detection, identification, and breeding behavior. They should receive a copy of the *Birds of North America* Snowy Plover Species Account (Page et al. 1995) and are required to read the sections on behavior and breeding. Training may include audio and visual materials, however training in the field is necessary if:

  1. They have never previously participated in any type of Snowy Plover survey,
  2. They do not have extensive field experience distinguishing between Snowy Plovers and other shorebird species (for example: Wilson's Plover, Killdeer, Semipalmated Plover, etc),
  3. They have little or no experience around nesting plovers,
     or,
  4. They have no experience reading color bands (for sites where color-banded birds might be observed).

At the very least, each surveyor should have successfully observed at least one Snowy Plover in the field prior to conducting any surveys.

DATA SUBMISSION

After you return from the field, enter data into the online database:
http://fresc.usgs.gov/products/snpl_database
Make copies of all data sheets and maps. Mail original data and maps to your regional coordinator (see Appendix 3) within one month from survey completion date.

LITERATURE CITED

Page, G.W., J.S. Warriner, J.C. Warriner, and P.W.C. Paton. 1995. Snowy Plover (*Charadrius alexandrinus*). *In* The Birds of North America, No. 154 (A. Poole and F. Gill, eds.). The Academy of Natural Sciences, Philadelphia, PA, and The American Ornithologists' Union, Washington, D.C.

APPENDICES

Appendix 1. Data Form

2007 Snowy Plover Survey		**Page _____ of _____**
State: **Site Name** (on field map)**:**	**Lat/Long** (field map cntr pt)**:**	**Date:** **Repeat Visit (Y/N):**
Number of Observers:_____ **Observer(s) Name & Contact info (phone, email):**		
Survey Type (check one): Foot _____ Airboat _____ ATV_____ Motorboat _____		**Habitat Code**[a] (indicate main habitat in survey area)**:** **Was all suitable habitat surveyed (Y/N)?** _____
Total Person-hours:_____, If multiple methods (hrs/type): Foot____ Airboat____ATV_____ Motorboat____		**If multiple teams are covering this site, please indicate your team letter here:____** **(mark it on your map)**
Start Time:_____ Temp:_____F/C Sky[b]**:_____ Wind**[c]**:_____**		
End Time:_____ Temp:_____F/C Sky[b]**:_____ Wind**[c]**:_____**		

Survey Area: Circle all suitable habitats surveyed on site map(s) provided. Indicate patches of unsuitable habitat (i.e. water or dense vegetation) within area surveyed with a crosshatch pattern. Also, circle any areas with suitable habitat that you were unable to survey and mark with parallel hatches (explain the circumstance in General Comments below). Take into account that habitat and waterline may not be the same as that shown on field map(s). Write your team letter on the map; note plover or nest locations on the map by writing the number corresponding to the column "Map #" below.

Map #	# Adults Detected				Lat/Long Coordinates (WGS 84)	[d]Behavior Code	Comments (#chicks/nests, additional behaviors supporting breeding designation (see protocol appendices, ~~disturbances, reference to~~ banded birds, etc.)
	M	F	U	Total			

[a]**Habitat: A** = Alkali Lake, **P** = Playa, **Re** = Reservoir, **Ri** = River Channel, **Se** = Seeps and Springs, **Im** = Impoundments and Evaporation Ponds, **Sa** = Sandy Beaches, **B** = Barrier Islands, **E** = Estuaries and Lagoons, and **Is** = Islands and Islets

[b]**Sky Code: 0** = clear or a few clouds; **1** = partly cloudy (scattered) or variable sky; **2** = cloudy (broken) or overcast; **4** = fog or smoke; **5** = drizzle or light rain; **7** = snow; **8** = showers

[c]**Wind**: **0** = smoke rises vertically (<1 mph); **1** = wind direction shown by smoke drift (1-3); **2** = wind felt on face, leaves rustle (4-7); **3** = leaves, small twigs in constant motion; light flag extended (8-12); **4** = raises dust and loose paper, small branches are moved (13-18); **5** = small trees in leaf sway; crested wavelets on inland waters (19-24)

[d]**Behavior: F –** Foraging, **R** – Roosting, **B** – Breeding (this can include copulation, distraction displays, nests, etc. If possible, explain in the comments section and be sure to get approximate coordinates for any nests found), FO – Flyover (not previously counted, returning to an area already counted), **U** – Unknown

General Comments (Change in methods, visibility, other variables that may affect results. Use back of form for more space).

2007 Snowy Plover Survey (Additional Data Sheets)	Page _____ of _____

State: Site Name (on field map):	Date:	Observer Name(s):

Map #	# Adults Detected				Lat/Long Coordinates (WGS 84)	[a]Behavior Code	Comments (#chicks/nests, additional reproductive behaviors noted, disturbances, reference to banded birds, etc.)
	M	F	U	Total			

Banded Plover Sightings (Do not interrupt or delay the survey to read bands)		
Map #	Combo (L:X/Y; R:X/Y)	Notes (Coordinator notified?, bands confirmed by two or more observers, etc.)

General Comments **(Change in methods, visibility, other variables that may affect results, etc. Use back of form for additional space):**

Appendix 2. Behaviors* used to confirm breeding status (note highest confirmed behavior in comments section of the field form).

Pair (PR) – A male and female plover in close proximity (approx 3m).
Agitated Adult (AA) – Running (sometimes flying) away from a disturbance. *Upright Display* often used when agitated or mate guarding. This display consists of males standing in an elevated, upright posture with the neck extended and breast feathers erected. The *Horizontal Display* also indicates agitation. In the horizontal display, males hold their bill, body and tail horizontal to the ground with the neck extended and throat feathers erected as the male walks in a partial crouch.
Territorial Defense (TD) – Running or flying at other plovers and occasionally other shorebirds. Elevated defense consist of fights between two birds (often males) "leaping breast-to-breast", their wings fluttering, as each combatant pecks and pushes at the other." This behavior is often preceded with the upright and/or horizontal displays (described above).
Distraction Display (DD) – Running in a crouched posture away from intruders typically appearing injured (broken wing display).
Courtship (CC) – Male initiates courtship with the horizontal display followed by scraping, bowing, pointing his head toward the ground 1 to several times, and flashing his tail. The female will run from the scraped area created by the male up to 2m away and stand with her body parallel to the ground or slightly tilted forward. The male will follow and stand directly behind the female and kick his legs high. Copulation typically follows.
Nest Building (NB) – While building a "scrape" the male leans forward on his breast and scratches with his feet while rotating his body around.
Incubating Adult (ON) – On nest often flattened to the ground.
Nest With Eggs (NE)
Adult With Young (AY) – The adult (typically the male) will often fly back and forth usually while flying or run using a distraction display. Look for chicks crouched below the flight path of the adult. If chicks are running, adults will lead the chicks away from the disturbance. Look for chicks following the adult. Above all, **Do Not Disturb** the birds further and be very careful where you step.
Young Alone (JV) - Be sure to look in the general vicinity for other young and be very careful where you step.

*Definitions taken from Page, et. al. 1995

Appendix 3. Contact Information for Regional Survey Coordinators

UNITED STATES

CA, NV, and overall Survey Coordinator
Sue Thomas
USFWS Migratory Birds and Habitat Programs
911 NE 11th Ave
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503-231-6164
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OR
Elise Elliott-Smith
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541-750-7390
Eelliott-smith@usgs.gov

Appendix 4. Guidelines for ATV Surveys

Although surveyors are free to take any form of transportation to get to area(s) of potential Snowy Plover foraging and breeding habitat, conducting surveys by ATV is discouraged. However, in certain situations, surveying by ATV is the only way that a site can be covered. Some of the circumstances that may constitute the need for ATV surveys are:

- When the habitat is very extensive and/or it's size and quality is unfamiliar to the surveyor.
- When surveying a very long dike road bordering a large wetland or complex of wetlands.

AND

- When there not enough surveyors available to cover the site in one day by foot.

If you believe that the circumstances at your site constitute a need for ATV coverage, **talk to your regional coordinator prior to conducting the survey**. When surveying by ATV, refer to these additional guidelines:

1. **If you are only using an ATV to access your site (or to get to the stretch of shoreline that you are surveying), you are not conducting an "ATV survey".** If you are walking while you are looking for birds, you are conducting a "foot survey".
2. When conducting an ATV survey, follow the general methodology for foot surveys as closely as possible. Substitute "driving" for every time the methods refer to "walking".
3. Driving speed should be **no more than 10 mph while scanning for plovers.** Also reduce your speed if you are driving through an area where plovers may be nesting and proceed with extreme caution (reverse and give a wide berth to any adults giving distraction displays).
4. Unless habitat is extremely narrow (< 20 m or 66 ft.), you must stop the ATV every 100 m (656 ft.) and scan with binoculars and a spotting scope. If habitat is greater than 20 m (66 ft.) wide, scanning with your naked eye will not be sufficient. If habitat is greater than 100 m (328 ft.) wide, a spotting scope is required. Follow the general guidelines,
5. Stop if you encounter a flock of plovers. In order to get an accurate count, you should stop, take a moment to count the flock, and scan for other birds in the area.

Appendix 5. Guidelines for Airboat and Motorboat Surveys

Although surveyors are free to take any form of transportation to get to area(s) of potential Snowy Plover foraging and breeding habitat, conducting surveys by airboat or motorboat is discouraged. However, in some circumstances, surveying with an airboat or motorboat may be the only practical way to obtain adequate coverage of the habitat. Examples of such situations are:

- When surveying extensive shallow water areas.
- When there is a broad band (>100 m) along the shoreline of unconsolidated mud (that is impossible to walk on).
- On long stretches of river or large reservoirs with small patches of inaccessible habitat.
- On islands where foot traffic is limited or prohibited.

If you believe that the circumstances at your site constitute a need for surveying by airboat or motorboat, **talk to your regional coordinator prior to conducting the survey**. When surveying by airboat or motorboat, refer to these additional guidelines:

1. **If you are only using an airboat or motorboat to access your site (or to get to the stretch of shoreline that you are surveying), you are not conducting an "airboat survey" or a "motorboat survey".** If you are walking while you are looking for birds, you are conducting a "foot survey".
2. When conducting an airboat or motorboat survey, follow the general methodology for foot surveys as closely as possible. Substitute "driving" for every time the methods refer to "walking".
3. Driving speed should be **no more than 10 mph while scanning for plovers.**
4. At least two people should be in the boat. One person in the boat should focus on driving while the other is continuously scanning with their naked eyes and binoculars.
5. Stop the boat every 100 m (328 ft.) and do a quick stationary scan with binoculars followed by a spotting scope. Using a spotting scope is particularly important in broad areas that are shallowly flooded.
6. If the boat causes binoculars and/or spotting scopes to shake you will need to stop more frequently.
7. In very broad shallows (>200 m), it may be necessary to run transects perpendicular to the shoreline or zig-zag through the shallows. In general, it is preferable to drive along a single transect that runs parallel to the shoreline (as in the general methodology for foot surveys). However, a single transect will not suffice if shallows are very broad (> 200 m), or if moderately broad (>100 m) but conditions cause optics to shake (even when boat is stopped). In such situations, if you do not have multiple boats available to run parallel transects simultaneously, you will need to run transects perpendicular to the shoreline or zig-zag through the shallows.
8. Use a combination of methods if there is inland habitat that can not be viewed from the boat. If possible, survey in unison with surveyors covering the upland area by foot or ATV.
9. Encircle islands/sandbars or disembark and cover by foot if they are > 100 m (328 ft.) wide and/or there is any vegetation obstructing views.

Appendix 6. Field Checklist

Required Survey Materials and Equipment
Survey Protocol
Data Sheets and clipboard
Map/aerial photograph(s) of your survey site (provided by regional coordinator)
Pens and pencils
Binoculars for every surveyor (magnification 8-10x and aperture of at least 40 mm.)
Spotting scope (for each solo surveyor, and for every other surveyor in a team (*see* Figure 1))
Time piece
GPS units (for each solo surveyor, and for every other surveyor in a team (*see* Figure 1))
Hand-held radio/walkie-talkie (for every surveyor in a team)
Extra batteries

Recommended Materials and Equipment
Waterproof field notebook
Road maps and directions to your site
Cell phone
Contact list
Water
Sun block
Rain jacket and pants
Sturdy boots (particularly in rattlesnake country!)

Appendix 7. Color Band Observations

Familiarize yourself with this appendix prior to conducting surveys if color banded birds are likely to be observed at your site. If you see a color banded Snowy Plover, **contact your regional coordinator within 24 hrs if you are unable to read the band combination with confidence**.

Guidelines for recording color bands:

1. Surveyor(s) may attempt to read bands ONLY after birds at a given location on the survey route have been accurately counted and recorded. Plovers should be within close range to check for color bands since similar colors can be mistaken at longer distances. If there are more than one observers present, try to have another observer check your color combinations to check for accuracy. This may be done be using a spotting scope if available, or by approaching birds closely and using binoculars.
2. If it is permissible to approach roosting birds by making them stand, great care must be taken not to cause them to fly ahead of the observer as it will confound the count going forward. DO NOT APPROACH a bird on a nest or an adult with chicks. DO NOT APPROACH a female head-bobbing, a male tail-dragging, birds copulating, nest scraping, birds performing a broken wing display, or an adult with chicks. These are strong indicators that birds are breeding in the area or will breed soon and it is very important that you DO NOT DISTURB them.
3. Spend no more than 5 minutes obtaining any single color band combination and if there are multiple color-banded individuals in an area, limit the time spent band reading to no more than 15 minutes. This limitation is necessary because spending long amounts of time in any one area may result in an increased detection rate. After determining color band combinations, carefully walk around birds and continue the survey.

Reading color bands: Some sites have the potential to have color banded birds. Color bands allow biologists to keep track of productivity, movement patterns, and survivorship. Aluminum bands, provided by the U.S. Fish and Wildlife Service, are used in addition to plastic bands; both are usually covered with colored tape.

Colors used on the Pacific Coast are aqua (A, light blue), dark blue (B), dark green (G), lime (L, light green), red (R), yellow (Y), and white (W), orange (O), violet (V), pink (P), brown (N), and black (K). Tape occasionally peels off revealing metallic (silver) band (S).

Color bands are read top down from the belly to the foot of the bird (Figure 2). Colors on the birds left leg are read first, and then the colors on the right leg are read. For example, if a bird has two aqua bands on its right leg and a white band on top of a red band on its left, its combination would be: white, red, aqua, aqua. This combination would be recorded WR:AA.

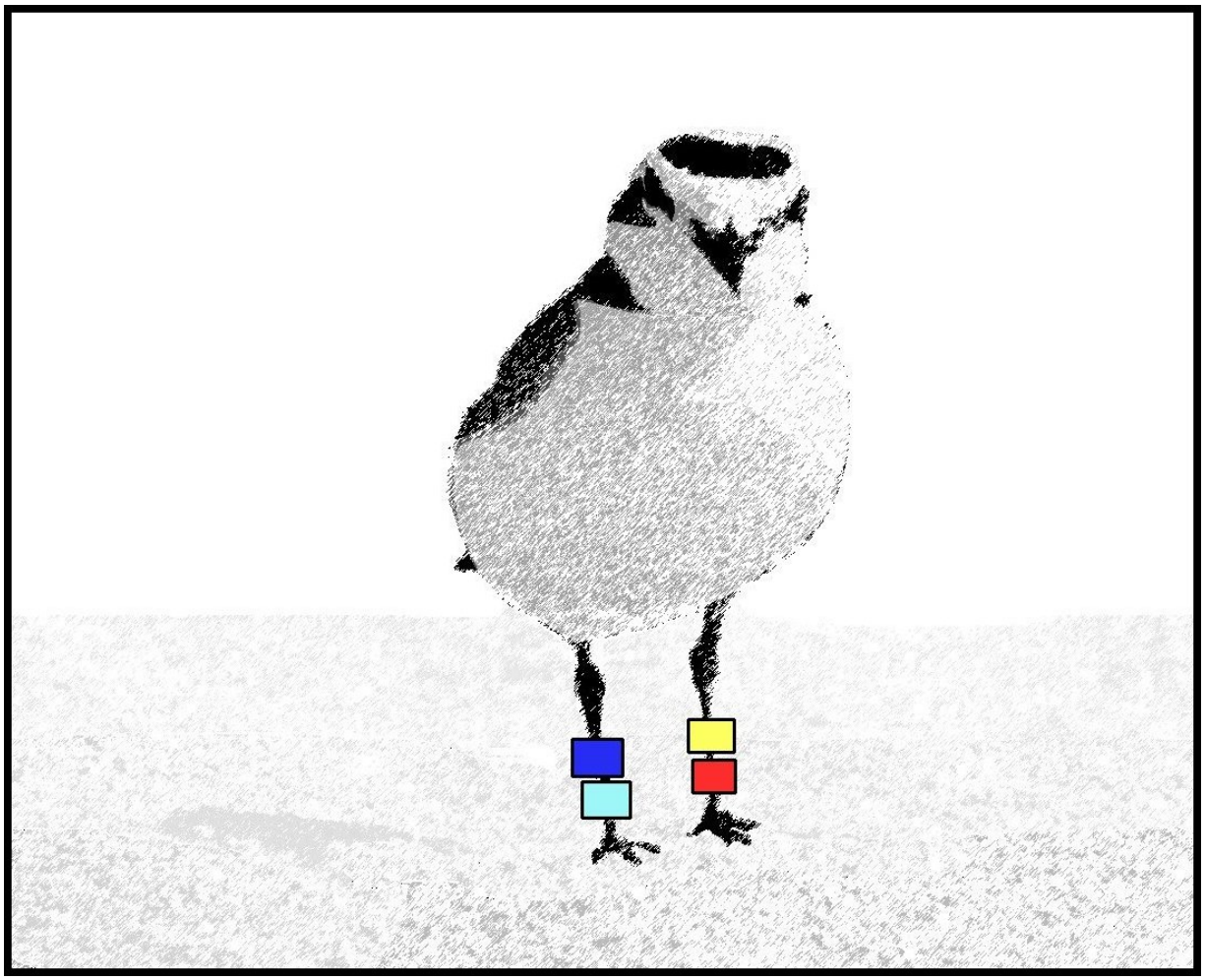


Figure 2. Example of banded Snowy Plover. In this picture the bird has a yellow band (Y) above a red band (R) on its left leg and a blue band (B) above an aqua band (A) on its right leg. This combination should be recorded as YR:BA.

Appendix 8. Examples of Completed Data Forms and Field Maps.

2007 Snowy Plover Survey — Page 1 of 2

State: TX
Site Name (on field map): Plover Lake
Lat/Long (field map cntr pt): 45.6789 123.4567
Date: May 17 2007
Repeat Visit (Y/N): N

Number of Observers: 2
Observer(s) Name & Contact info (phone, email): Ima Plover ima-plover@usfws.gov (203) 456-8889
Jenny Pasonsandpiper j-pasonsandpiper (408) 789-0234

Survey Type (check one): Foot ✓ Airboat ____ ATV ____ Motorboat ____
Habitat Code[a] (indicate primary habitat in survey area):
Was all suitable habitat surveyed (Y/N)? N

Total Person-hours: 7.5, If multiple methods (hrs/type): Foot ____ Airboat ____ ATV ____ Motorboat ____
If multiple teams are covering this site, please indicate your team letter here: A (mark it on your map)

Start Time: 645 Temp: 70° (F)/C Sky[b]: 0 Wind[c]: 0

End Time: 10:30 Temp: 78° (F)/C Sky[b]: 0 Wind[c]: 1

Survey Area: Circle all suitable habitat surveyed on site map(s) provided. Indicate patches of unsuitable habitat (i.e. water or dense vegetation) within area surveyed with a crosshatch pattern. Also, circle any areas with suitable habitat that you were unable to survey and mark with parallel hatches (explain the circumstance in General Comments below). Take into account that habitat and waterline may not be the same as that shown on field map(s). Write your team letter on the map; note plover or nest locations on the map by writing the number corresponding to the column "Map #" below.

Map #	# Adults Detected				Lat/Long Coordinates (WGS 84)	[d]Behavior Code	Comments (#chicks/nests, additional behaviors supporting breeding designation (see protocol appendices, disturbances, reference to banded birds, etc.)
	M	F	U	Total			
1			1	1	45.6723 123.4789	F	
2	1	1		2	45.5990 123.4795	U	
3			1	1	45.5982 123.4703	U	
4		1		1	45.5890 123.4770	B	nest found with 3 eggs!

[a]**Habitat:** **A** = Alkali Lake, **P** = Playa, **Re** = Reservoir, **Ri** = River Channel, **Se** = Seeps and Springs, **Im** = Impoundments and Evaporation Ponds, **Sa** = Sandy Beaches, **B** = Barrier Islands, **E** = Estuaries and Lagoons, and **Is** = Islands and Islets
[b]**Sky Code:** **0** = clear or a few clouds; **1** = partly cloudy (scattered) or variable sky; **2** = cloudy (broken) or overcast; **4** = fog or smoke; **5** = drizzle or light rain; **7** = snow; **8** = showers
[c]**Wind:** **0** = smoke rises vertically (<1 mph); **1** = wind direction shown by smoke drift (1-3); **2** = wind felt on face, leaves rustle (4-7); **3** = leaves, small twigs in constant motion; light flag extended (8-12); **4** = raises dust and loose paper, small branches are moved (13-18); **5** = small trees in leaf sway; crested wavelets on inland waters (19-24)
[d]**Behavior:** **F** – Foraging, **R** – Roosting, **B** – Breeding (this can include copulation, distraction displays, nests, etc. If possible, explain in the comments section and be sure to get approximate coordinates for any nests found), FO – Flyover (not previously counted, returning to an area already counted), **U** – Unknown

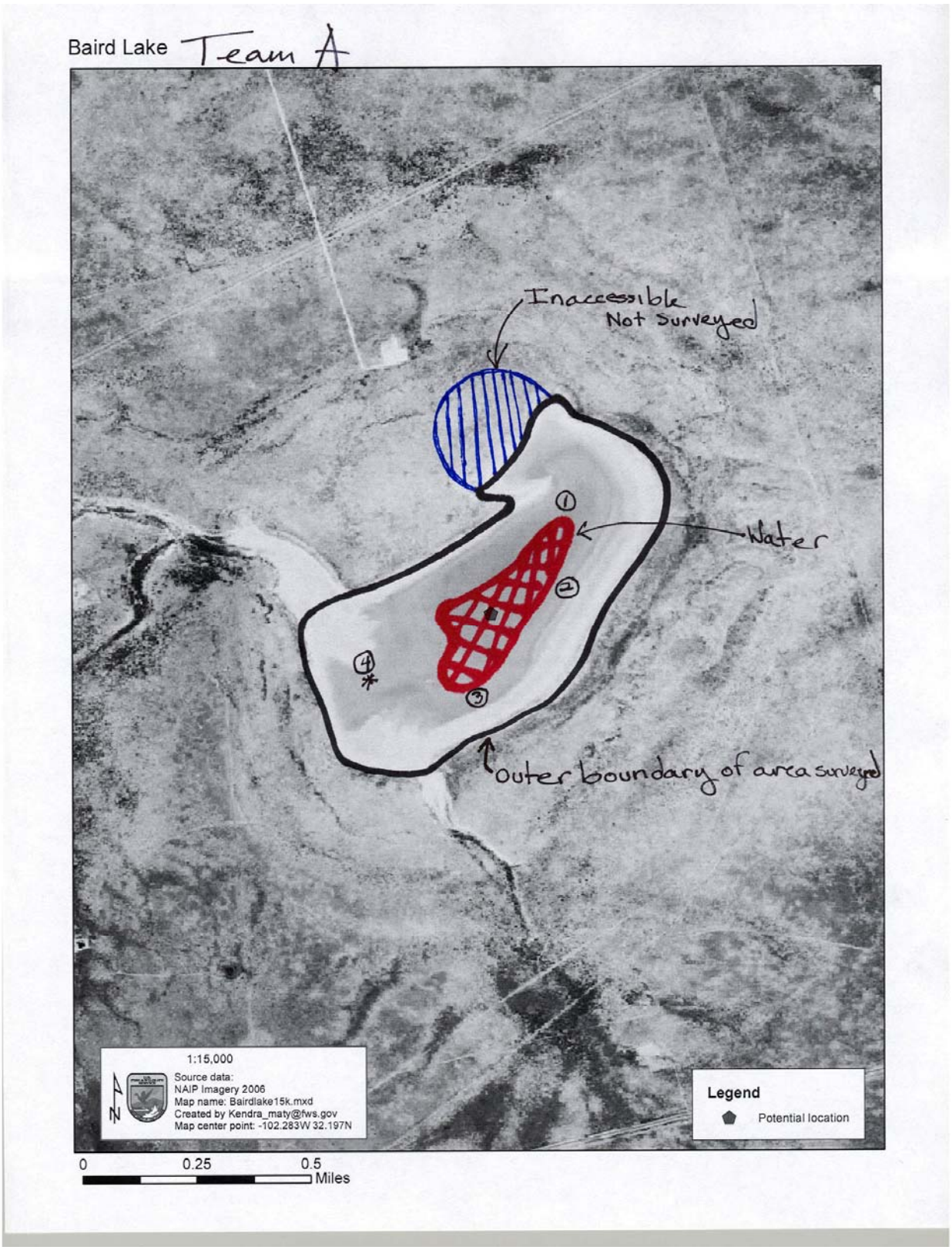
Banded Plover Sightings (Do not interrupt or delay the survey to read bands)

Map #	Combo (L:X/Y; R:X/Y)	Notes (Coordinator notified?, bands confirmed by two or more observers, etc.)
	None	

General Comments (Change in methods, visibility, other variables that may affect results, etc. Use back of form for additional space)

See p2.

Comments: There were flats to the northwest of Plover Lake that we could not access (see map) This area looked to have pretty good habitat but we think it is privately owned due to the barbed-wire fencing. Unfortunately, we do not have landowner permission.


Baird Lake Team A
Inaccessible
Not Surveyed
Water
Outer boundary of area surveyed
1:15,000
Source data:
NAIP Imagery 2006
Map name: Bairdlake15k.mxd
Created by Kendra_maty@fws.gov
Map center point: -102.283W 32.197N
Legend
Potential location
0
0.25
0.5
Miles